Global Aerosol Measurement System (GAMS)

Completed Technology Project (2015 - 2016)

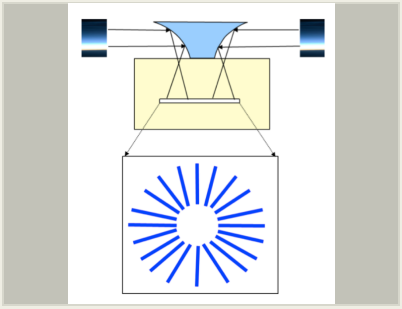
Project Introduction

The Global Aerosol Measurement System (GAMS) project is developing a new, low cost satellite capability for measuring the properties and distributions of particles in the upper troposphere and lower stratosphere (collectively, the UTLS). This altitude region is important because there have been observed increases in the amount of particles in the UTLS. These particles typically reflect sunlight back into space and cool the Earth. GAMS will measure the altitudes and amounts of these particles by looking to the side of the spacecraft, through the thickness of Earth's atmosphere, and provide detailed information about how particles are changing in the UTLS.

The goal of the Global Aerosol Measurement System (GAMS) project is to develop needed technologies and obervation strategies to optimally measure the distributions and properties of particles in the upper troposphere and lower stratosphere (UTLS). The GAMS concept is based on the limb-scattering measurement techniques used on past sensors, most directly from the heritage of the Ozone Mapping and Profiling Suite (OMPS) Limb Profiler (LP) currently flying on board the Suomi National Polar-orbiting Partnership (NPP) spacecraft. OMPS-LP was launched on Suomi NPP in 2011, with the next planned launch of this instrument in 2022 on the next generation Joint Polar Satellite System-2 (JPSS-2). Because of the length of time between the NPP and JPSS-2 launches there is the potential for a significant data gap for these important measurements. The GAMS concept is intended to be a simple and low cost measurement system that could be ready to fill such a gap.

The current OMPS-LP system measures light reflected by particles in the UTLS by looking behind the Suomi NPP path, looking through the thickness of Earth's atmosphere (i.e., the limb). Although OMPS-LP has proven capable of detecting the presence of background particles in the UTLS, as well as particles from volcanic eruptions and meteorites entering Earth's atmosphere from space, it has very limited spatial coverage and suffers from sensitivity issues since it preferentially sees particles in one direct with respect to the sun. GAMS seeks to overcome both limitations by making measurements of reflected light In two or more directions relative to the spacecraft flight. Because GAMS focuses only on the limb profiling capabilities (versus the more comprehensive by more complicated OMPS system) it can be contained in a relatively smaller spacecraft, which will reduce deployment costs. Additional increased spatial coverage can be realized by flying multiple copies of the GAMS instrument in different orbits.

At this stage of the GAMS project we are refining science requirements and measurement capabilities. Working with simulations of Earth's atmosphere from the NASA Goddard Earth Observing System (GEOS-5) atmospheric model we are refining both the number of viewing directions and the number of



Top of figure shows side view of instrument, with mirror system in blue at top observing Earth?s illuminated limb. Ray traces show optical path of observed light to detector arrays (as seen from above at bottom of figure).

Table of Contents

Global Aerosol Measurement System (GAMS)

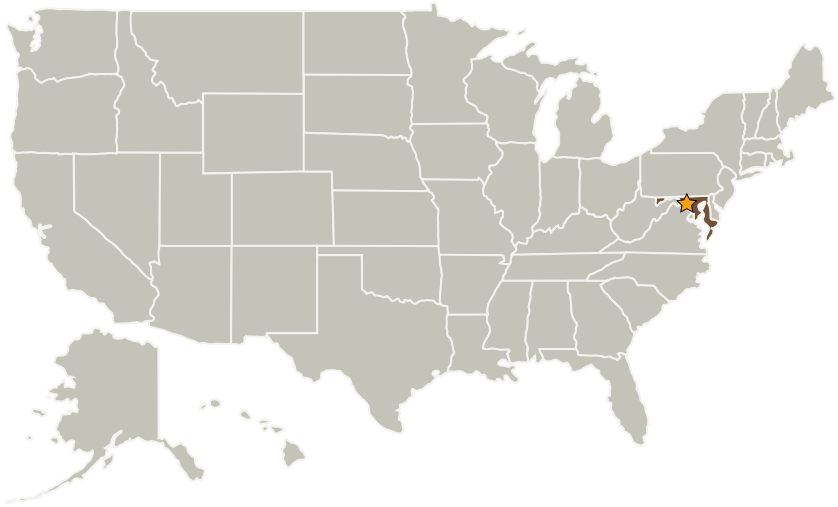
Completed Technology Project (2015 - 2016)

spectral channels needed to adequately measure the particles in the UTLS. Engineering work is being performed to refine the GAMS measurement strategy, focused on detector design.

Anticipated Benefits

The technologies developed in the Global Aerosol Measurement System (GAMS) project will lead to a more capable, low cost measurement system for monitoring the vertical distributions of particles in the UTLS.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Science Systems and Applications, Inc.(SSAI)	Supporting Organization	Industry	Hamtpon, Virginia

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

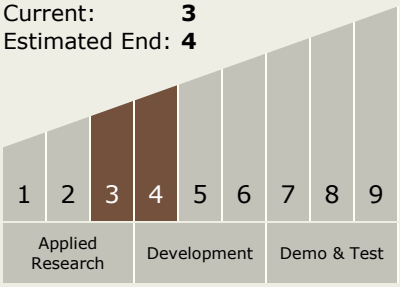
Matt Mcgill

Principal Investigator:

Peter R Colarco

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



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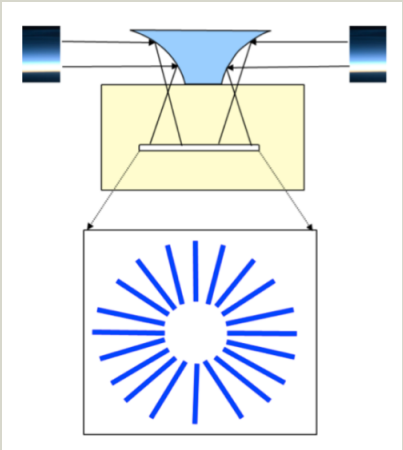
Completed Technology Project (2015 - 2016)

Images



The Global Aerosol Measurement System (GAMS) observing concept
Top of figure shows side view of instrument, with mirror system in blue at top observing Earth?s illuminated limb. Ray traces show optical path of observed light to detector arrays (as seen from above at bottom of figure). *(https://techport.nasa.gov/image/18988)*

Project Website:

http://sciences.gsfc.nasa.gov/sed/

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.3 Optical Components